Vocabularies for Describing Pedagogical Approach in e-Learning: A Scoping Study

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Abstract: This paper scopes and discusses the need for identification, development and use of vocabularies that describe the pedagogical aspects of e-learning resources such as learning objects and learning activity designs. The focus is particularly on UK post-16 education.

Keywords:
pedagogy, vocabularies, pedagogical approach, education, learning objects, learning activities, learning activity designs, IEEE LOM, IMS Learning Design, DC-Education.

1. Introduction

1.1 Background and overview

In 2005 the JISC[1] Pedagogical Vocabularies Project scoped the potential for identification, development and use of pedagogical vocabularies for the UK post-16 and higher education communities. After a period of data gathering and community consultation, a working group of experts from various sectors and communities developed two reports that were submitted to the JISC, along with a set of recommendations, in December 2005. These reports were the Pedagogical Vocabularies Review (1); and the Vocabulary Management Technologies Review (2).

This paper discusses issues arising from the first report in the following four broad

[1] The UK Joint Information Systems Committee: http://www.jisc.ac.uk/

areas:
1. The emergence of a need for a new type of descriptive vocabulary, i.e. one that supports: (a) description of the pedagogical approach of a resource; or, (b) description of the pedagogical principles involved in a learning activity, learning activity design, or case study of teaching; or, (c) sharing amongst teachers of possible pedagogies within which a given resource has been or may be used.
2. The suitability and characteristics of existing vocabularies and those under development.
3. The particular problems involved in developing, maintaining and using pedagogical vocabularies, and possible solutions.
4. Recommendations for future research and development in this area.

1.2 Scope

The Oxford English Dictionary defines pedagogy as: "The art, occupation, or practice of teaching. Also: the theory or principles of education; a method of teaching based on such a theory" (3). It defines a vocabulary as: "The range of language of a particular person, class, profession, or the like" (4). The JISC study was not limited to providing an inventory of the kind of controlled vocabulary traditionally used in metadata; it was interested in *any* vocabularies that may be used to describe pedagogy, particularly in the sense of the practices of teaching (which are inherently and dialogically related to the practices of learning). However, identifying or developing useful controlled vocabularies for describing pedagogical aspects of resources is clearly one key component to fulfilling resource sharing needs in e-learning. Moreover, such vocabularies must in some way be based upon or reflect the wider professional or theoretical vocabularies in use within teaching and learning, so a review of both is necessary as a basis for future work.

The study reported on here focused on teaching in UK higher and further (i.e. vocational) education. Although there was some input from abroad, non-UK vocabularies were not investigated comprehensively. While this paper maintains that focus, clearly there is much scope for further work in this area in other educational levels and internationally.

2. The emerging need for pedagogical vocabularies

2.1 The learning object economy

International interest in the sharing, reuse and repurposing of learning objects within a "learning object economy" (5) has brought with it an increasing interest from educational developers and teachers in describing and sharing information about the sequencing of learning objects, the educational context within which they are used, and the educational purpose that they fulfil. Expectations of what metadata standards and vocabularies can provide in support of these emergent needs has somewhat out-stripped what existing standards currently support, although work is under way to address this beyond the JISC study reported on here[2]. However, these needs are also being approached from the angle of describing, specifying and sharing interoperable learning activity designs.

2.2 Learning design and IMS Learning Design

[2] For instance, DC-Ed Application Profile work and work bringing together DC and IEEE LOM; both may be found at: http://dublincore.org/groups/education/ ;

The field of learning design has emerged in recent years as a distinct offshoot of instructional design, with its own paradigms and protocols (6) Chief among these is a focus on learner activity, rather than on content or the purely administrative aspects of pedagogic support. IMS Learning Design (7) is an interoperability specification that provides formal XML expression for the design of learning activities, so that they may be delivered and shared across a range of platforms. The strength of this specification is that, in contrast to the didactic pedagogical model implied by current learning management systems (LMSs), it can be used to describe and deliver a wide range of pedagogies, including group work, problem-based learning and so on. Learning design, and the IMS Learning Design specification, have together provided a particular momentum to the search for shared pedagogical vocabularies because of the perceived value of such vocabularies in describing learning designs. Any vocabularies used to support the specification must:

a) Focus on learning activities, rather than on broad approaches to or theories of learning;

b) Identify and articulate (at least) the following elements:

- Type of learning activity
- Desired learning outcomes
- Learning systems or services required in the activity
- Other aspects of the learning environment
- Roles of participants in the learning activity.

c) Reflect common usage among those educational practitioners who are likely to be developing and exchanging learning designs.

These developments have highlighted a lack of common understanding of, and shared vocabularies for, pedagogical practice amongst teachers, system developers, learning technologists and e-learning researchers. This is a stumbling block for development of innovative systems that teachers actually want to use, and for reuse and sharing of learning designs. Moreover, descriptions of learning materials and pedagogical approaches is increasingly being seen as important within a wider context of improving teaching and learning in general, as Robyn & Dalziel (8) note:

"These requirements make clear the need for new conceptions of learning object meta-data, and new ways of using repositories—not just for search and retrieval, but as a living, growing body of shared practice."

Practitioners' needs for pedagogical vocabularies (and indeed the needs of other stakeholders) are clearly broader than the need for good quality metadata.

2.3 The needs of stakeholders

The e-Learning and Pedagogy[3] strand of the JISC e-Learning Programme has highlighted the fact that educational practitioners and learning technologists perceive a real and pressing need for pedagogical vocabularies:

"Original consultation emphasised need for: 'a common language for describing all this'. We know there are problems translating between research projects, developer requirements, and real examples of practice [...] really important (question) 'What

[3] http://www.elearning.ac.uk/elearningandpedagogy

would you want or need to use a pedagogical vocabulary for?' We really need to understand more about the ways in which educational vocabularies, and other structured accounts of pedagogy, might be useful." (9)

From the teachers' perspective there is a need to find a way to describe common practice so that resources can be discovered and shared across the community. From an e-learning development perspective, learning technologists, system developers and teachers need to find ways of communicating with each other so that they can create materials and tools that reflect the real needs of teachers. Although there are many models of practice in existence in education, the models used by those working in the field of e-learning do not necessarily relate to the models used by teaching practitioners. Many teachers are not reflective practitioners, and so do not describe their teaching approaches with the formal terms used by educational researchers. Often, teachers are not aware of these formal terms and models, and the approaches that they personally adopt are implicit.

2.4 Summary of requirements for pedagogical vocabularies

It is apparent that the requirements of stakeholders within education vary enormously and, to date, have not been clearly articulated in a coherent fashion. The type of activities and developments identified by the JISC study that pedagogical vocabularies can help to facilitate include:

a) *Application and tool development* – in particular the development of tools that support and facilitate the sharing of e-learning practice and that are usable and meaningful to teachers and learners.

b) *Personalisation* - of content, tools, and teaching and learning environments according to pedagogical preferences, styles and principles.

c) *Articulation* – shared pedagogical vocabularies can help teachers and learning technologists to reflect on their practice and discuss it in coherent terms. This is of particular importance in a domain where both practice and technology is undergoing rapid development.

d) *Cross-domain communication* – vocabularies act as a crucial bridge to enable communication between system developers, learning technologists, educational developers, practitioners and learners.

e) *Resource description and discovery* – there is a need for vocabularies that are capable of describing educational content and learning designs and activities from a pedagogical perspective. This will enable teachers to learn from others' practice and to exchange, share, reuse, adapt and enhance these resources.

f) *Conceptual modelling* - of the learning design domain.

These requirements necessitate different types of controlled vocabulary, with application and tool development; personalisation; and resource description and discovery being the most likely to require the kind of controlled vocabularies used in implementing interoperability standards such as DC (10), IEEE LOM (11) and IMS Learning Design (12).

3. Pedagogical vocabularies: the current landscape

3.1 Metadata standards and pedagogical vocabularies

3.1.1 IEEE LOM

The IEEE LOM defines a number of vocabularies for describing educational attributes of resources, particularly within the elements of category *5: Educational*. The

vocabulary defined for *5.2 Learning Resource Type* is worth particular note, as it includes a mixture of terms for physical resource type (e.g. slide, table) and for resource types that suggest a pedagogical approach (e.g. lecture, self-assessment). Partly (but not entirely) due to this problem, some implementers have found this vocabulary to be insufficient to meet their local needs, so there are a number of application profiles[4] that have defined their own LOM Learning Resource Type vocabularies.

The IEEE LOM Category *9: Classification* elements may also be used to describe pedagogical attributes of a resource. This category lends itself to the use of thesauri, classification schemes and taxonomies as well as flat lists of terms. However, there is some evidence that this potential has been not taken up by many implementers (13).

3.1.2 Dublin Core

The latest version of the DC Education Application Profile (14) includes the element *Instructional Method*, which is defined in the Dublin Core usage guide as:

"A process, used to engender knowledge, attitudes and skills, that the resource is designed to support. Instructional Method will typically include ways of presenting instructional materials or conducting instructional activities, patterns of learner-to-learner and learner-to-instructor interactions, and mechanisms by which group and individual levels of learning are measured. Instructional methods include all aspects of the instruction and learning processes from planning and implementation through evaluation and feedback." (15)

DC-Ed doesn't yet define a vocabulary; it recommends the use of a controlled vocabulary "whether developed for the use of a particular project or in general use in an educational context". However, the DC-Ed Working Group is looking at defining a small number of the GEM vocabularies for use in *Instructional Method*; the examples given in the above-mentioned usage guide are taken from GEM's Teaching Method, Grouping and Assessment vocabularies (16).

3.2 IMS Learning Design and pedagogical vocabularies

IMS Learning Design provides elements within which relevant vocabularies could be recommended or specified. While some projects have used or adapted existing pedagogic vocabularies, others have set out to develop and test their own. One reason for this seems to be the difficulty of identifying existing vocabularies that meet the requirements noted above in Section 2.2. The elements of the IMS Learning Design specification, and particularly the focus on learning activity as the basic unit of description, already imply a logical structure to the description of learning that differs from the rationale behind many existing vocabularies.

3.3 Knowledge organization systems for education as a subject in the UK

While the JISC study was under way, the DfES[5] was undertaking a review of more traditional controlled vocabularies for the education sector (16). In addition, maintainers of the British Education Index's (BEI) British Educational Thesaurus

[4] For example the UK LOM Core http://www.cetis.ac.uk/profiles/uklomcore and CanCore http://www.cancore.ca/en/

[5] Department for Education and Skills (Government Department for England and Wales): http://www.dfes.gov.uk/

(BET), based at the University of Leeds[6], recently carried out strategic development and planning work. Their long-term plan is for delivery of the BEI and BET as an integrated service. Phil Sheffield, Manager of BEI, played an active role in the JISC Pedagogical Vocabularies Project Working Group, while Stella Dextre Clarke, consultant to the DfES review, gave helpful feedback on early drafts of the JISC study's report documents. However, it is not yet clear how, or even if, any pedagogical vocabularies developed within e-learning will relate to subject vocabularies covering education as a discipline. What is certain is the importance of e-learning experts and information specialists communicating at the level of vocabulary review and development, so that any mutual affordances may be taken advantage of.

3.4 An inventory of existing vocabularies

The primary purpose of the two review reports was to provide an inventory of what already exists for the use of learning technologists and others developing e-learning tools and courses. Organizing the inventoried vocabularies into a coherent framework for a heterogeneous audience proved to be a challenge. While not attempting to create a definitive taxonomy of vocabularies, the Working Group developed a grouping felt to be useful to readers whether they were from an educational, technological or information management background:

1. Descriptions of models of educational theory and practice;
2. Knowledge organization tools for education as a discipline;
3. Universal vocabularies with significant educational sections;
4. Assessment vocabularies;
5. Medical education vocabularies;
6. Folksonomies.

The inventory describes these vocabularies using a schema based on *Section 4.4: Use of LOM for Describing Vocabularies* from CEN Working Agreement 14871 (17). The elements of vocabularies described within this schema are: Identifier (assigned internally to the report); Title; Language; Description; Coverage; Aggregation level (refers to granularity or level of detail of the vocabulary); Version; Status; Contributor; Contributor role; Contribution date; Format; Size; Location; Technical requirements; (Vocabulary) Type; Intended end user role; Context; Rights; Relation (to other vocabularies). Time constraints limited the amount of research it was possible to do into all of these aspects of the vocabularies described, so the main objective was to glean information from whatever primary source was found. In addition, some of the vocabularies listed in the first section are not knowledge organisation tools and so weren't amenable to description using this schema and were simply noted with some explanation and reference (e.g. Bloom's Taxonomy). This paper focuses on summarising and analysing the data from the first three groupings.

3.4.1 Descriptions of models of educational theory and practice

The difference between educational models, and vocabularies developed for resource description and discovery, is that they have been developed to help practitioners and/or researchers make sense of a highly context-dependent and complex set of human practices. Different models focus on different features of these practices, such as the organisational context, the interpersonal dialogues that take place, learners' developing skills or the required curriculum. However, controlled vocabularies for resource

[6] British Educational Index: http://www.leeds.ac.uk/bei/

description and discovery may be based upon them. There are a number of reviews of educational models available.(18) The JISC e-Learning and Pedagogy strand[7] recently funded such a review, which developed a useful three-part mapping elucidating how people learn (19) within a wider scope than that included in the review report. However, the JISC study reported on here summarizes five models (Bloom's (20) Taxonomy, Laurillard (21) Paulsen (22), Salmon (23), Shuell (24) which are commonly used by educational technologists and teaching practitioners in the UK. Of these five, Bloom's Taxonomy (20) is one of the most commonly known and it has widespread use in curriculum development. Practitioners may be encouraged to frame 'learning outcomes' for individual sessions or units using terms from this taxonomy, and a number of controlled vocabularies use Bloom's as a basis.

This section in the report also briefly notes the field of patterns and patterns languages (25) and their possible use in e-learning development for sharing learning designs. The European E-LEN Project is an example of use of the pattern approach (26).

Finally, this section inventories a number of current attempts to develop controlled vocabularies for use with the IMS Learning Design specification and/or other learning activity design systems or repositories. A number of these vocabularies are linked to or based on existing models of the learning process such as Bloom's. Initiatives carrying out this work include: DialogPlus[8] (UK/US-based; developed a taxonomy of learning approaches for use with reusable learning objects and has carried out a review comparing it with IMS Learning Design); 8LEM[9] (European-based; vocabulary based on eight 'learning events';); LearningMapR[10] (UK project working with IMS LD tool RELOAD[11], and initially using Bloom's as a theoretical framework but intending to allow users to substitute their own models for Bloom's); R2R Learning Design[12] (Canada-based; developing a repository of IMS LDs); SMART Learning Design Framework[13] (Australia-based); LAMS Community[14] (Australia-based but international community around repository of learning activity designs; descriptions include keyword tagging of designs).

3.4.2 Knowledge organisation tools for education

This broad category includes both traditional vocabularies (i.e. those developed mainly for use as subject descriptors) and vocabularies developed for use in metadata elements other than subject. It was decided in the end not to put effort into defining and delineating these two types as the line between them is not clear in practice. Eighteen controlled vocabularies relating to education were catalogued in this section of the report.

A number of traditional or standard education thesauri from around the world were listed. Of these the ERIC Thesaurus[15] was the only one that had more

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[7] http://www.elearning.ac.uk/elearningandpedagogy
[8] http://www.dialogplus.org/
[9] http://www.unfold-project.net/providers_folder/providers_resources/LEM/8LEM
[10] http://wcker.conted.ox.ac.uk/
[11] http://www.reload.ac.uk

[12] http://commons.ucalgary.ca/weblogs/learningdesign/
[13] http://www.smartinternet.com.au/SITWEB/research/proj.jsp?id=15
[14] http://lamscommunity.org/
[15] http://www.eric.ed.gov/ERICWebPortal/Home.portal?_nfpb=true&_pageLabel=Thesaurus&_nfls=false

than a few basic pedagogy terms, but its US emphasis limits its usefulness for a UK audience. Other vocabularies listed that did include coverage of pedagogy terms were: the AERS[16] and TLRP vocabularies[17] (UK-based; for describing educational research items for two similar DSpace repositories); the CELEBRATE[18] Learning Resource Type and Learning Principles vocabularies (designed for an application profile of the LOM, giving narrow but detailed pedagogy coverage); the DLESE[19] Resource Type and Teaching Method vocabularies (also for LOM descriptions, the latter drawn heavily from the GEM teachingMethod vocabulary; US-based); the GEM[20] vocabularies themselves (Assessment; Grouping; and teachingMethod; again US-based but widely used; referenced by DC-Ed AP); the HEA Pedagogy and Learning Resource Type vocabularies[21] (UK-based, used with the LOM); the Learning Federation Metadata Application Profile Vocabularies[22] (Australia/NZ-based; for schools); the SeSDL[23] Taxonomy (has detailed pedagogy coverage; developed in 2000 for use with IMS Learning Resource Metadata in the Classification element; already showing signs of being dated); the SOURCE[24] RESLI[25] vocabularies (includes a Pedagogy vocabulary that is not particularly detailed).

3.4.3 Universal vocabularies with significant educational sections

The term 'universal' as used here means that the vocabularies are intended to cover all possible subjects. None of the universal vocabularies listed had any notable pedagogy coverage and were included to inform readers of their relevant characteristics.

4. Developing pedagogical vocabularies

It was clear from the JISC study's inventory of existing vocabularies relevant to pedagogy that there is little currently available that would be appropriate for wide use, although there are a number of innovative projects whose work should be monitored. Developing existing or new vocabularies for pedagogy is problematic. Education is one of those disciplines where the vocabulary and indeed the meanings of terms are often radically different between educational sectors, cultures and countries. For example, in the UK the educational meanings of the terms 'assessment' and 'evaluation' almost exactly transpose their meanings in American education. In addition, particularly within e-learning, terminology and trends around educational theories and approaches evolve rapidly.

However, one key barrier uncovered by the study is that the pedagogical vocabularies used and understood within educational theory and research are not necessarily used by the practitioners who use teaching and learning resources. Eliciting their conceptualisations and vocabularies about pedagogy is therefore a topic of great interest within e-learning, arguably vital for its success.

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[16] http://www.aers.org.uk/aers/
[17] http://www.tlrp.org/dspace
[18] http://celebrate.eun.org/docs/CELEB_AP_v1.1_2003-12-15.pdf
[19] http://www.dlese.org/Metadata/adn-item/0.6.50/docs/framework-documentation.htm#146
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[23] http://www.sesdl.scotcit.ac.uk/
[24] http://www.source.ac.uk/
[25] http://www.resl.ac.uk/browse.cfm

4.1 Eliciting users' knowledge.

4.1.1 Domain analysis

The practice of 'domain analysis' within information science involves looking at communities of practice or discourse communities and how they talk about their particular domain, for a variety of purposes, not just information retrieval. At present it is primarily geared towards scientific domains, but there are many approaches within domain analysis, that may be of relevance to the development of pedagogical vocabularies[26].

4.1.2 Card sort and cluster analysis

The use of sorting exercises with end users to elicit their own conceptualisation of knowledge structures, sometimes followed by cluster analysis, has been in use for some time in the design of website architecture and in other kinds of information systems design. In 2002, Tennis (2003) (27) tested this methodology for the development of interoperable educational metadata vocabularies, in this case looking at Audience. This work was built upon in 2003 by the SIESWE Learning Exchange in developing a subject taxonomy for social work education; it is yet to be evaluated.

4.1.3 Folksonomies / Collaborative tagging

Folksonomies or collaborative tagging may be seen as a user-centred methodology for developing vocabularies, although it is currently fairly rudimentary and controversial from an information science perspective. This approach could have potential for developing pedagogical vocabularies, as it may allow a shared language to develop as teachers describe and share resources within online communities. A paper submitted by the authors in the JISC Innovating e-Learning Online 2006
Conference drew out a discussion around the potential of the use of such collaborative tagging activities and systems and their potential for describing and sharing learning designs; the following comment exemplifies the optimism found toward these approaches:

"Attempts to develop and share learning designs can become bogged down in the discipline specific vs generic diatribe. I think that folksonomies created by individual metatagging in blog and wiki environments can lead to more effective sharing and dissemination of ideas because of their organic growth within social spaces. Furthermore, at the moment the informality of networking technologies like blogs and wikis gives them real effectiveness in parallel with "institutional" VLEs, which may or may not have caught up with the ethos wikis/blogs etc. espouse. There is excitement over the sense of having acquired a new form of expression and of being fully part of it." (28)

This type of approach could also provide ways to link formal metadata vocabularies with more informal learning object descriptions, as suggested recently in the CETIS Metadata and Digital Repositories SIG discussion list.

" [. . .] the simple vocabularies that we have been developing in activities like RLLOMAP[27] share a lot of similarities with folksonomies [. . .] It occurred to me that it is these 'lomtologies' (LOM-based

[26] See, for example: Hjørland (2002) and Mai (2005).
[27] http://www.rdn.ac.uk/publications/rdn-ltsn/ap/

folksonomies) that potentially form the glue between formal metadata systems like DC and LOM and the more informal, lightweight tagging approaches to resource discovery?"(29)

5. Recommendations

Both the JISC Pedagogy Programme and the Pedagogical Vocabularies Project have highlighted the fact that educational practitioners and elearning technologists perceive a need for pedagogical vocabularies. However it is apparent that the requirements of the community vary enormously and, to date, have not been clearly articulated in a coherent fashion. Therefore, the study made recommendations to the JISC for further funding and research in the following areas:

- Support for the use of vocabularies across the JISC community;
- Pedagogical vocabularies and learning designs;
- Vocabularies, reference models and the eFramework;
- Semantic web technologies;
- Usage and mapping of existing controlled vocabularies within the domain of e-learning;
- Community generated vocabularies;
- Vocabulary creation resources and guidelines.

It also identified activities that the JISC could consider undertaking in order to support further developments:

- Gathering use cases and scenarios of vocabulary usage in different contexts across different domains;
- Evaluation of how vocabularies are used in different domains and sectors (e.g. teaching and learning, information management, administrative computing, e-research, etc.) and what they are used for (e.g. resource description, resource discovery, personalisation, a common language for talking about practice, application interface development, etc.).
- Examination of the interface and relationships between the language and terminology used by teachers, learners and learning technologists.
- Identifying the key characteristics (e.g. environment, context, pedagogy, etc.) that need to be described and articulated to enable the reuse of different types of resources, (e.g. educational content, learning designs, etc.).
- Investigate the applicability of "domain analysis" to teachers, learning technologists and systems developers.

6. Conclusions

The JISC is currently investigating how the recommendations from this study can be taken forward in their planning of new programmes of work. A recent development in this area is the JISC Design for Learning Programme (30) in which projects were asked to reference and build on the work of this study. Clearly there are many challenges ahead in this complex area, and there are a range of different approaches and developments that may be built upon. It is hoped that the JISC study, and this paper building on it, will form a solid foundation from which to start.

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